

THE CLAIMS

What is claimed is:

1. A pathway determination system for a data storage system having N storage devices and more than N pathways for retrieving requested data from the data storage system, the pathway determination system comprising:

a sorter receiving a read request and separating the read request into an appropriate segment size for sending to the storage devices of the data storage system;

an assigner selecting a read permutation satisfying the received read request, the selected read permutation being based on a predetermined metric, and the assigner sending the selected read permutation to the storage devices of the storage system; and

a collector receiving the requested data from the N storage devices in response to the selected read permutation being sent to the storage devices.

2. The system according to claim 1, wherein the assigner further generates the read permutations satisfying the received read request.

3. The system according to claim 2, wherein the read permutations are generated before the read request is received.

4. The system according to claim 1, wherein the assigner includes:

a permutation generator generating the read permutations; and

a cost calculator calculating an expense of each permutation based on the predetermined metric.

5. The system according to claim 4, wherein the cost calculator utilizes queue length information and estimated current cost information, and

wherein the permutation generator generates a reduced number of read permutations based on the queue length information and the estimated current cost information.

6. The system according to claim 5, wherein the cost calculator calculates the expense of each permutation further based on performance information received from the storage devices of the storage system.

7. The system according to claim 1, wherein the storage system includes at least one failed storage device.

8. The system according to claim 1, wherein the metric is dynamically changed based on a change in operating conditions of the storage system.

9. The system according to claim 8, wherein the metric is periodically changed based on operating conditions of the storage system.

10. The system according to claim 1, wherein the metric is based on a current workload balance for the storage devices of the data system.

11. The system according to claim 1, wherein the metric is based on an estimated delay before the requested data can be retrieved from the storage devices of the storage system.

12. The system according to claim 1, wherein the metric is based on a number of outstanding requests in the queue of a storage device of the storage system.

13. The system according to claim 1, wherein the metric is based on a total queue for all outstanding requests that have been received by the storage system.

14. A method for determining a pathway for obtaining data stored in a data storage system having N storage devices and more than N pathways for retrieving requested data from the data storage system, the method comprising steps of:

receiving a read request from a requester;

separating the read request into an appropriate segment and size for sending the storage devices of the data storage system;

selecting a read permutation from possible read permutations satisfying the received read request;

sending the selected read permutation to the storage devices of the storage system;

receiving the requested data from the N storage devices in response to the selected read permutation being sent to the storage devices; and

returning the satisfied read request to the requester.

15. The method according to claim 14, further comprising a step of generating the read permutations satisfying the received read request.

16. The method according to claim 15, wherein the step of generating the read permutations is performed before the read request is received.

17. The method according to claim 15, further comprising a step of calculating an expense of each permutation based on the predetermined metric.

18. The method according to claim 17, further comprising steps of:

generating queue length information and estimated current cost information,
and

generating a reduced number of read permutations based on the queue length information and the estimated current cost information.

19. The method according to claim 18, wherein the step of calculating the expense of each permutation is further based on performance information received from the storage devices of the storage system.

20. The method according to claim 14, wherein the storage system includes at least one failed storage device.

21. The method according to claim 14, further comprising a step of dynamically changing the metric based on a change in operating conditions of the storage system.

22. The method according to claim 14, further comprising a step of periodically changing the metric based on operating conditions of the storage system.

23. The method according to claim 14, wherein the metric is based on a current workload balance for the storage devices of the data system.

24. The method according to claim 14, wherein the metric is based on an estimated delay before the requested data can be retrieved from the storage devices of the storage system.

25. The method according to claim 14, wherein the metric is based on a number of outstanding requests in the queue of a storage device of the storage system.

26. The method according to claim 14, wherein the metric is based on a total queue for all outstanding requests that have been received by the storage system.